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RESEARCH IN TRANSITION



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EVALUATION OF FEED CONVERSION EFFICIENCY FOR BULLS ON TEST

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BACKGROUND

Finding a measure of efficiency in feed conversion for bulls on test which is appropriate for purposes of selection has been an elusive goal. One may select to maintain the rate of growth while reducing feed intake, to maintain feed intake while increasing growth rate, or to reduce intake and increase growth rate simultaneously. The challenge in the long run is to reduce, through genetic change, feed and other costs per unit of gain.

At the farm, a higher rate of gain is of benefit because it spreads out maintenance costs. There is also economic importance in the amount of feed required to get that rate of gain under any given circumstances. Factors that need to be considered are the level of production or size of livestock operation, the environment in which animals are raised, and the stage of their physiological development. These factors must be taken into consideration along with measurements of gain and of feed intake in any assessment of feed conversion efficiency.

Feed intake for individual animals can now be recorded electronically at some OMAF bull test stations. The project outlined here assessed the usefulness of a new measure of efficiency based on this intake information and the relationship of this measurement to selection for breeding stock.

OBJECTIVES

The project had two main objectives:

1. to examine the factors influencing feed conversion of bulls on test; and
2. to develop selection criteria based on the assessment of feed conversion of bulls on test.



PROJECT DESIGN

Data were gathered from the Arkell Bull Test Station and from a related project at the Elora Research Station. The data from Arkell are from three groups of about 30 bulls each, tested between the spring of 1982 and 1983. Data from Elora were from the same period and from animals fed and managed in a similar manner.

At Arkell, the bulls enter the testing facility at about 230 days of age. They are housed in a pole barn open to the south and fed a complete pelleted ration. The bulls are given 28 days to adjust to the new surroundings; each 28 days after that, they are weighed for a total of six weighings. The amount that each animal eats during each of the five 28-day periods is measured. At the end of the trial, the thickness of the subcutaneous fat is measured by ultrasonic means.

RESULTS

As shown in Figure 1, the 'law of diminishing returns' appears to apply to the relationship between weight and cumulative consumption of feed. With weight plotted on the vertical axis and cumulative feed consumption on the horizontal axis, the curve rises from the initial weight W_0 at the start of the test to a final mature weight A . The rise becomes less steep as the total feed consumed increases until the curve is flat when the animal reaches mature weight.

The slope of the curve is the gain produced by 1 kg of feed. The slope as defined at 50% of mature weight is taken here as the measure of feed efficiency and is referred to subsequently as the 'slope measure of feed efficiency'.

WEIGHT

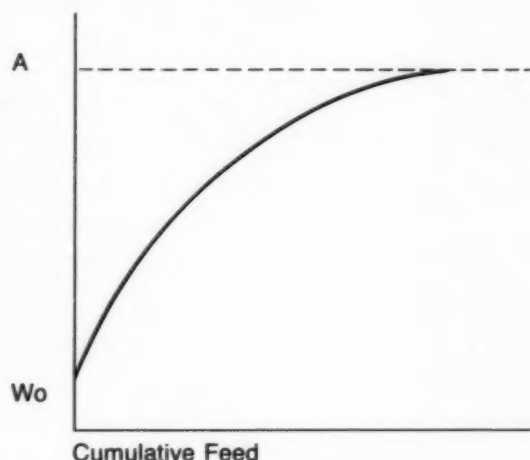


Figure 1: The law of diminishing returns

SLOPE MEASURE AND FEED EFFICIENCY (Table 1)

There was a positive correlation of 0.26, where $P = 0.02$, between the slope measurement of feed efficiency and the weight of the animal at the beginning of the test. One would assume from this that the heavier the animal was entering test, the more efficient it would be.

On the other hand, the gain-to-feed ratio was correlated negatively at -0.19 , where $P = 0.03$, in the Elora data and had no significant correlation from those at Arkell.

Both the slope measure of feed efficiency, at -0.27 where $P = 0.01$, and gain-to-feed ratio, at -0.62 where $P = 0.0001$, were correlated negatively with feed intake over the test period. From the standpoint of economic efficiency, the gain-to-feed ratio from these tests seems to emphasize the need to reduce feed intake; however, this is not necessarily desirable.

The correlation of average daily gain with the slope measure of feed efficiency was 0.02, where $P = 0.86$, from the Arkell data. This suggests that, if the same association holds true at a genetic level, selection on the basis of this measure will cause neither a significant

increase nor decrease in average daily gain. Selection for economic efficiency could then be a case of putting the appropriate emphasis on biological efficiency (slope) and growth.

The slope measure of feed efficiency is obtained easily using non-linear regression techniques. The estimate attempts to account for the stage of growth of the animal; however, while it shows promise for alleviating the problems associated with the gain-to-feed ratio, it is not always possible to get accurate estimates based solely on the six measurements taken for each bull on test. This is the case in particular for bulls not close to their mature weight by the end of test. The estimate of their mature weight, A , may be very inaccurate and, consequently, so will be the estimate of the slope.

CONCLUSIONS

The main conclusions to be reached from this research are:

1. feed conversion measurements are affected by the initial weight of the animal and by the composition of gain as well as by the time period over which measurements are taken;
2. simple gain-to-feed in a bull-test program is not a good measure of true efficiency;
3. further research is needed to determine the best criterion for selecting for efficiency; a possible solution at present is to choose sires which are predicted to fall within an acceptable range of market weight and then to choose from those the ones that reach that market weight most quickly on the least amount of feed.

There are still some difficulties in estimating efficiency from data available from bull-test stations. On the basis of the research reported here and other literature on the subject, the gain-to-feed ratio should not be considered as the criterion on which to select breeding animals for improved feed efficiency.

The slope measure of feed efficiency holds some promise if the difficulty of estimating the mature weight of bulls can be solved. More extensive study of what constitutes 'economic efficiency' on the farm would also be useful.

Table 1: Within-season and breed correlations among part of test weight (SOTWT), feed consumption (INTAKE), average daily gain (ADG), subcutaneous fat thickness at the end of test (FAT), gain-to-feed ratio (RATIO) and the slope measure of feed efficiency (SLOPE) pooled over all Arkell data. A correlation greater in magnitude than 0.21 is significant at 5%.

	INTAKE	ADG	FAT	RATIO	SLOPE
SOTWT	.17	.13	.17	-.19	.26
INTAKE		.54	.17	-.62	-.27
ADG			.24	.27	.02
FAT				-.02	.14